

Claims:

1. An unmanned system for investigating underwater regions,
2 comprising:

3 a plurality of unmanned underwater vehicles (UUVs),
4 each of said plurality of UUVs including propulsion and
5 navigation means for traversing an underwater region, sonar
6 means for generating sonar data associated with the
7 underwater region, electro-optic imaging means for generating
8 image data of selected areas of the underwater region, and
9 underwater communication means for transmitting said sonar
10 data and said image data through the water;

11 an unmanned mothership equipped for navigation through
12 the water, said unmanned mothership including, in modular
13 form, a first module for controlling navigation of said
14 unmanned mothership, a second module for receiving and
15 storing said sonar data and said image data transmitted
16 through the water from each of said plurality of UUVs, a
17 third module for storing and dispensing fuel, a fourth module
18 for propelling said unmanned mothership using said fuel from
19 said third module and steering said unmanned mothership in
20 accordance with instructions received from said first module,
21 and a fifth module coupled to said second module for
22 wirelessly transmitting said sonar data and said image data;

23 docking means mounted partially onboard said unmanned

24 mothership and partially onboard each of said plurality of
25 UUVs for coupling each of said plurality of UUVs to said
26 unmanned mothership, and for selectively releasing each of
27 said plurality of UUVs from said unmanned mothership into the
28 underwater region; and

29 guidance means mounted partially onboard said unmanned
30 mothership and partially onboard each of said plurality of
31 UUVs for guiding each of said plurality of UUVs back to said
32 docking means from positions in the water, wherein said
33 unmanned mothership transports said plurality of UUVs to and
34 from the vicinity of the underwater region, releases said
35 plurality of UUVs into the water, and facilitates recovery of
36 said plurality of UUVs from the water.

1 2. An unmanned system as in claim 1 wherein said underwater
2 communication means includes means for receiving underwater
3 acoustic transmissions, and wherein said unmanned mothership
4 further includes:

5 a GPS system having an antenna for receiving GPS
6 signals, said GPS system determining a position of said
7 unmanned mothership using said GPS signals; and

8 an acoustic transmitter coupled to said GPS system for
9 transmitting an acoustic signal into the water that is
10 indicative of said position so-determined, wherein said

11 acoustic signal is received by said underwater communication
12 means for use by said propulsion and navigation means.

1 3. An unmanned system as in claim 1 wherein said first
2 module includes a radio receiver for receiving navigation
3 instructions for said unmanned mothership over the airwaves
4 from a remote location.

1 4. An unmanned system as in claim 1 wherein said first
2 module comprises a pre-programmed navigation system for
3 directing said unmanned mothership along a predetermined
4 route.

1 5. An unmanned system as in claim 1 wherein said propulsion
2 and navigation means includes at least one rechargeable
3 battery, said unmanned system further comprising battery
4 charging means for recharging said at least one rechargeable
5 battery, said battery charging means having a first portion
6 that is mounted onboard said unmanned mothership and a second
7 portion that is mounted on each of said plurality of UUVs,

8 said first portion having a ferromagnetic material
9 formed into a nearly continuous loop wherein a gap is formed
10 between two opposing surfaces of said ferromagnetic material
11 that defines the ends of said nearly continuous loop with
12 said gap being submerged in the water, a first electric
13 conductor coiled about a portion of said ferromagnetic
14 material that is formed into said nearly continuous loop at a
15 region thereof opposing said gap, and an AC power source
16 coupled to said first electric conductor for applying an AC
17 voltage thereto,

18 said second portion having a block of said
19 ferromagnetic material sized to loosely fit in said gap while
20 being spaced apart from each of said opposing surfaces, a
21 second electric conductor coiled about a portion of said
22 block wherein said AC voltage applied to said first electric
23 conductor induces an electric current in said second electric
24 conductor when said block is positioned in said gap, means

25 for positioning said block in said gap, and means coupled to
26 said first electric conductor and said at least one
27 rechargeable battery for utilizing said electric current to
28 recharge said at least one rechargeable battery, and
29 said first portion further having means for keeping
30 said block spaced apart from said opposing surfaces when said
31 block is fitted in said gap.

1 6. An unmanned system as in claim 5 wherein said means for
2 keeping is a sleeve positioned in said gap.

1 7. An unmanned system as in claim 5 wherein said means for
2 keeping is an electrically insulating material interposed
3 between each of said opposing surfaces and said block.

1 8. An unmanned system as in claim 7 wherein said
2 electrically insulating material is selected from the group
3 consisting of rubber, nylon, plastic and glass.

1 9. An unmanned system as in claim 5 wherein said
2 ferromagnetic material is iron.

1 10. An unmanned system for investigating underwater regions,
2 comprising:

3 a plurality of unmanned underwater vehicles (UUVs),
4 each of said plurality of UUVs being (i) powered by at least
5 one rechargeable battery, and (ii) equipped to traverse an
6 underwater region, generate sonar data associated with the
7 underwater region, generate image data of selected areas of
8 the underwater region, and transmit said sonar data and said
9 image data through the water;

10 an unmanned mothership equipped to (i) navigate through
11 the water, (ii) receive and store said sonar data and said
12 image data from each of said plurality of UUVs, and (iii)
13 wirelessly transmit aid sonar data and said image data from
14 said unmanned mothership;

15 battery charging means for recharging said at least one
16 rechargeable battery, said battery charging means having a
17 first portion that is mounted onboard said unmanned
18 mothership and a second portion that is mounted on each of
19 said plurality of UUVs,

20 said first portion having (i) a ferromagnetic material
21 formed into a nearly continuous loop wherein a gap is formed
22 between two opposing surfaces of said ferromagnetic material
23 that defines the ends of said nearly continuous loop with
24 said gap being submerged in the water, (ii) a first electric

25 conductor coiled about a portion of said ferromagnetic
26 material that is formed into said nearly continuous loop at a
27 region thereof opposing said gap, and (iii) an AC power
28 source coupled to said first electric conductor for applying
29 an AC voltage thereto,

30 said second portion having (i) a block of said
31 ferromagnetic material sized to loosely fit in said gap while
32 being spaced apart from each of said opposing surfaces, (ii)
33 a second electric conductor coiled about a portion of said
34 block wherein said AC voltage applied to said first electric
35 conductor induces an electric current in said second electric
36 conductor when said block is positioned in said gap, (iii)
37 means for positioning said block in said gap, and (iv) means
38 coupled to said first electric conductor and said at least
39 one rechargeable battery for utilizing said electric current
40 to recharge said at least one rechargeable battery, and

41 said first portion further having means for keeping
42 said block spaced apart from said opposing surfaces when said
43 block is fitted in said gap;

44 docking means mounted partially onboard said unmanned
45 mothership and partially onboard each of said plurality of
46 UUVs for coupling each of said plurality of UUVs to said
47 unmanned mothership, and for selectively releasing each of
48 said plurality of UUVs from said unmanned mothership into the

49 underwater region; and

50 guidance means mounted partially onboard said unmanned
51 mothership and partially onboard each of said plurality of
52 UUVs for guiding each of said plurality of UUVs back to said
53 docking means from positions in the water, wherein said
54 unmanned mothership transports said plurality of UUVs to and
55 from the vicinity of the underwater region, releases said
56 plurality of UUVs into the water, and facilitates recovery of
57 said plurality of UUVs from the water.

1 11. An unmanned system as in claim 10 wherein each of said
2 plurality of UUVs is further equipped to receive underwater
3 acoustic transmissions, and wherein said unmanned mothership
4 is further equipped to (i) receive GPS signals, (ii)
5 determine a position of said unmanned mothership using said
6 GPS signals, and (iii) transmit an acoustic signal into the
7 water that is indicative of said position so-determined,
8 wherein said acoustic signal is received by each of said
9 plurality of UUVs for use in traversing the underwater
10 region.

1 12. An unmanned system as in claim 10 wherein said unmanned
2 mothership is further equipped to receive navigation
3 instructions for said unmanned mothership over the airwaves

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4 from a remote location.

1 13. An unmanned system as in claim 10 wherein said unmanned
2 mothership is further equipped to direct said unmanned
3 mothership along a predetermined route.

1 14. An unmanned system as in claim 10 wherein said means for
2 keeping is a sleeve positioned in said gap.

1 15. An unmanned system as in claim 10 wherein said means for
2 keeping is an electrically insulating material interposed
3 between each of said opposing surfaces and said block.

1 16. An unmanned system as in claim 15 wherein said
2 electrically insulating material is selected from the group
3 consisting of rubber, nylon, plastic and glass.

1 17. An unmanned system as in claim 10 wherein said
2 ferromagnetic material is iron.